



Preface



Albert J. Shih¹ and Lihui Wang²

¹NAMRI/SME Scientific Committee Chair
University of Michigan
Ann Arbor, Michigan, USA
shiha@umich.edu

²NAMRI/SME Scientific Committee Chair-Elect
KTH Royal Institute of Technology
Stockholm, Sweden
lihuiw@kth.se



We are delighted and proud to present the collection of manufacturing research in the 44th North American Manufacturing Research Conference (NAMRC 44). NAMRC has a rich tradition, started from a group of distinguished manufacturing researchers, we called them Founders, in North America in 1973. After 44 years, NAMRC is recognized as the preeminent international forum for presentations and dissemination of original basic and applied research in advanced manufacturing.

Manufacturing has regained the global recognition and increased investment in research funding support due to its impact to transform the society. This is represented in the quality and quantity of the 123 research papers presented at the

NAMRC 44 held in Blacksburg, Virginia in 2016.

The Proceedings of the North American Manufacturing Research Institution of SME (NAMRI/SME) was published in Elsevier's *Procedia Manufacturing*, an open

access venue for manufacturing conference proceedings, for the first time in NAMRC 43. The publication in *Procedia Manufacturing* has broadened the availability of NAMRC papers and helped the dissemination of our manufacturing research findings. Top NAMRC papers are selected by editors of SME's *Journal of Manufacturing Systems* (JMS) and *Journal of Manufacturing Processes* (JMP), also published by Elsevier. Collaboration with *Procedia Manufacturing* also shortens the time for fast-track to JMS and JMP. In close collaboration with Professors Neil Duffie (JMS Editor) and Shiv Kapoor (JMP Editor), we have fast-tracked 4 and 12 papers to JMS and JMP, respectively, in 2016.

The Scientific Committee of NAMRI/SME is a group of Associate Chairs who handle the paper review. They are the driving force of NAMRI/SME. We have 36 colleagues who served as Associate Chairs in the following seven tracks.

Track 1 Manufacturing Systems (Lead: Lihui Wang*)

James Kong*, Laine Mears*, Shihming Wang, Jeonghan Ko*,
[Manufacturing Implementation] John Agapiou, David Stephenson

Track 2 Manufacturing Processes (Lead: Yuebin Guo)

Wayne Cai**, Gary Cheng**, Jingyan Dong**, Changshen Guo,
Yong Huang, Gap Kim**, Brad Kinsey, Gracious Nagile**, Tugrul Ozel,
Sathyan Subbiah, Murali Sundaram**, Tony Schmitz, Yancheng Wang,
Benxin Wu**, Bi Zhang

Track 3 Additive Manufacturing (Lead: Meisam Salahshoor)

Jingyan Dong**, Vijay Jagdale, Sagar Kamarthi, Yong Huang,
Murali Sundaram**

Track 4 Cyber-Physical Systems in Manufacturing (Lead: Lihui Wang*)

Yuan-Shin Lee, Binil Starley

Track 5 Manufacturing Education and Workforce Development (Lead: Hitomi Yamaguchi)**

Dean Bartle, Bryan Dods

Track 6 Ranga Komanduri Memorial Symposium (Lead: Shiva Raman)

Satish Bukkapatnam, S. Chandrasekar, James Kong*, Don Lucca

Track 7 David Dornfeld Memorial Symposium (Lead: Moneer Helu)

* Associate Editor of JMS

** Associate Editor of JMP

The assistance and dedication of all Associate Chairs are critical for the Scientific Committee and their service and contributions are greatly acknowledged.

In 2016, in collaboration with the ASME Manufacturing Engineering Division, (MED), we explored to collect papers in **Manufacturing Research Implementation**. John Agapiou and David Stephenson co-led this effort. We hope

to expand the submission to form a new Track in 2017. We encourage the submission of your papers in manufacturing research implementation to NAMRC. In 2016, we have three new tracks. One is the **Manufacturing Education and Workforce Development**, which is also in collaboration with the ASME MED. Another is the **Ranga Komanduri Memorial Symposium** to honor our colleague, Late Professor Ranga Komanduri. The other symposium, **David Dornfeld Memorial Symposium**, in collaboration with ASME MED, was arranged by collection of existing NAMRC and ASME MSEC papers to honor our dear friend and colleague, Late Professor David Dornfeld, who passed away in April 2016.

A Young Reviewers Panel has been created to recognize outstanding reviewers who have received their PhD in the past five years and senior PhD students. Our goal is to engage young manufacturing researchers, who are future leaders of our community, with NAMRI/SME. In 2016, 36 panelists were recommended by the Associate Chairs. The following are members of the **44th NAMRC Young Reviewers Panel**:

Kaveh Bastani <i>Virginia Tech</i>	Matthew Krugh <i>Clemson University</i>
Vadim Bromberg <i>GE Global Research</i>	Mathew Kuttolamadom <i>Texas A&M University</i>
Roland Chen <i>Washington State University</i>	Mingyang Li <i>University of South Florida</i>
Changqing Cheng <i>Turner Broadcasting System</i>	Ziye Liu <i>University of Alabama</i>
Dongping Du <i>Texas Tech</i>	Juan Ma <i>Turner Broadcasting System</i>
Xiaoliang Jin <i>Oklahoma State University</i>	Parikshit Mehta <i>Alcoa</i>
Siyang Gao <i>Hong Kong City University</i>	Hadi Miyanaji <i>University of Louisville</i>
Haijun Gong <i>Georgia Southern University</i>	Farbod Akhavan Niaki <i>Clemson University</i>
Terri Jia <i>GE Global Research</i>	Arash Pourhabib <i>Oklahoma State University</i>
Blake Johnson <i>Virginia Tech</i>	Prahalada Rao <i>SUNY Binghamton</i>
Jaydeep Karandikar <i>GE Global Reserch</i>	Mark Rubeco <i>UNC Charlotte</i>
Sunwook Kim <i>Virginia Tech</i>	Dinakar Sagapuram <i>Texas A&M University</i>

Michael Sealy
University of Nebraska Lincoln

Jianbo Sui
United Technologies Research Center

Thanongsak Thepsonthi
Burapha University

Chris Tyler
Boeing

Durul Ulutan
Bucknell University

Ruoshui Wang
Texas A&M University

Zimo Wang
University of South Florida

Lee Wells
Western Michigan University

Li Yang
University of Louisville

Eda Yildirim-Ayan
University of Toledo

Xin Zhao
Clemson University

Yihao Zheng
University of Michigan at Ann Arbor

In closing, we acknowledge the advice from Neil Duffie, Shiv Kapoor, and John Ziegert (Past Chair of the NAMRI/SME Scientific Committee), the professional support of the NAMRI/SME Board of Directors, and SME staff Suzy Marzano. We also recognize the support of Dr. Gaia Lupo of Elsevier. She has worked with us in the past three years to make the transition to Procedia Manufacturing possible. Finally, we are excited about the future of NAMRC and our manufacturing research community.

July 10, 2016

Albert J. Shih
University of Michigan at Ann Arbor
NAMRI/SME Scientific Committee
Chair

Lihui Wang
KTH Royal Institute of Technology
NAMRI/SME Scientific Committee
Chair-Elect

NAMRC and NAMRI

The North American Manufacturing Research Conference (NAMRC) is the flagship event of the North American Manufacturing Research Institution of SME (NAMRI/SME)—the premier international forum where academic and industrial leaders in manufacturing interact with each other and advance the field. The distinctive feature of NAMRC is the presentation and critical discussion of research on technical innovations and new methods and applications of leading-edge technology from around the world.

NAMRC was organized in 1973 by a group of researchers interested in discussing and disseminating research results in the field of manufacturing. For its first few years, the event was known as the North American Metalworking Research Conference, but the word “manufacturing” soon began to be used to recognize the expanding base of research. From its inception in 1973 until 1981, NAMRC was facilitated through its Scientific Committee. In 1982, NAMRC became an affiliated organization of the Society of Manufacturing Engineers (SME) and became known as NAMRI/SME.

NAMRI/SME brings together researchers from leading companies, government laboratories, academic institutions, and industrial think tanks located around the world for the purpose of advancing the scientific foundation of discrete-parts manufacturing. This group’s work covers refining fundamental technologies and developing emerging technologies and processes for material removal and material forming, as well as research on manufacturing modeling, simulation, monitoring, and control systems.

A bound volume of papers presented at NAMRC was been produced, under the titles *Proceedings* and *Transactions*, from 1973 to 2010 to serve as a permanent record of the research ideas and results presented and discussed at the annual conference. Beginning in 2011, the *Proceedings of NAMRI/SME* was published in CD format only, and in 2015 Elsevier’s *Procedia Manufacturing* becomes the publishing venue for the *Proceedings of NAMRI/SME*.

At NAMRC, many important scientific and technological milestones have been set by renowned researchers. The NAMRI/SME proceedings in *Procedia Manufacturing* continue the archival record that has faithfully documented the tremendous evolution of manufacturing science and technology in the recent decades.

2015-2016 NAMRI/SME Board of Directors

President

Steven R. Schmid
University of Notre Dame

President-Elect

Dean L. Bartles
Digital Manufacturing and
Design Innovation Institute

Secretary

Bryan Dods

Past President

Shreyes N. Melkote
Georgia Institute of Technology

Second Past President

Robert W. Ivester
U.S. Department of Energy

Scientific Committee Chair

Albert J. Shih
University of Michigan

Scientific Committee Chair-Elect

Lihui Wang
KTH Royal Institute of Technology

Directors

Livan Fratini
University of Palermo

Hitomi Yamaguchi Greenslet
University of Florida

Edward F. Smith III
Deringer-Ney, Inc.

David Stephenson
Ford Motor Company

John Ziegert
University of North Carolina
at Charlotte

Ex Officio

Thomas R. Kurfess
Georgia Institute of Technology

Presidents of NAMRI/SME

2015-16	Steve Schmid	1996-97	Warren R. DeVries
2014-15	Shreyes N. Melkote	1995-96	Alvin M. Sabroff
2013-14	Robert W. Ivester	1994-95	Delcie R. Durham
2012-13	John S. Agapiou	1993-94	Richard E. DeVor
2011-12	Jian Cao	1992-93	Goverdhan D. Lahoti
2010-11	Steven R. Hayashi	1991-92	Ranga Komanduri
2009-10	Y. Lawrence Yao	1990-91	David A. Dornfeld
2008-09	K. Scott Smith	1989-90	Klaus J. Weinmann
2007-08	Thomas R. Kurfess	1988-89	Alan T. Male
2006-07	Steven Y. Liang	1987-88	Taylan Altan
2005-06	Ralph L. Resnick	1986-87	Branimir F. von Turkovich
2004-05	Kornel F. Ehmann	1985-86	Inyong Ham
2003	Shiv G. Kapoor	1985	Serope Kalpakjian
2002	Philip H. Abramovitz	1984	William B. Rice
2001	Rajiv Shivpuri	1982-83	John G. Bollinger
2000	Chi-Hung Shen	1982	Jiri Tlusty
1998-99	Kamlakar P. Rajurkar		
1997-98	William R.D. Wilson		